

Intracranial Angioplasty and Stenting
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Introduction

Angioplasty has been applied to virtually every arterial system in the body, and intracranial applications really represent the final frontier. Intracranial vessels offer many problems when one considers balloon angioplasty. They are very small and very thin making perforation a real possibility. They are about as far from the usual access site (common femoral artery) as one can get and the path from the femoral access into the cranium can be extremely tortuous. Finally, the end organ is not muscle (as in the heart or the leg) or even renal or hepatic tissue. Instead it is the central nervous system where very small arteries supply extremely important tissues.

As with other areas, primary angioplasty has been performed but has had the problems of abrupt closure due to intimal damage, elastic recoil, thrombosis, etc. Abrupt closure in the distal carotid artery, middle cerebral artery, basilar artery, etc. often cannot be tolerated resulting in stroke or death. Stents have certainly improved these complications in other vascular beds and should do the same thing for intracranial vessels. However, assuming one could get a stent in position, very small arteries such as the lenticulostriates and pontine perforators must stay patent if the patient is to do well or even survive. Recently, a number of reports and small case series have been published regarding intracranial balloon angioplasty with and without stenting. Stenting has become a reality using low profile coronary systems a number of which are now available.

The presentation will be divided into a number of segments aimed at answering the following questions:

- What is the prevalence and distribution of intracranial atherosclerosis?
- What are the clinical sequelae of this disease?
- What are the treatment options other than endovascular therapy?
- Angioplasty and stenting: How to do it and what are the results?

As it turns out, intracranial atherosclerosis is quite common, particularly in certain races and accounts for a relative large number of strokes each year in the United States. Treatment options, both medical and surgical, are somewhat limited (particularly the latter). Therefore, intracranial angioplasty and stenting could make an impact on this difficult disease process. The tools and techniques for intracranial angioplasty of atherosclerotic disease are in their infancy and much research is needed to define its exact role and future directions.

Suggestions for Intracranial Angioplasty:

- Perform diagnostic angiography first
 - Allows evaluation of anatomy
 - Measurements
 - Obtain necessary supplies and assistance

- Patients should be placed on oral antiplatelet agents prior to the procedures
 - We use clopidogrel 75 mg qd 4 or more days prior to the procedure or a loading dose of 300mg (4 tabs) the day preceding the procedure. Patients should also be on a single adult aspirin (325 mg qd). If a patient is allergic to clopidogrel, ticlopidine (250 mg bid) can be substituted.

- General Anesthesia for procedure
 - Motionless patient
 - Control of vitals including airway, heart rate, blood pressure
 - Assistance in emergency
 - You only have to worry about a successful, safe procedure

- Angiography Suite
 - Best if biplane, but can be performed with single plane unit.
 - Prior angiography to determine optimal views/angles is really helpful
 - Use best possible fluoroscopy unit with road mapping capabilities
 - Difficult to see through petrous bone--need your best unit

- Supplies
 - Microcatheter/guide wires
 - Any of the available microcatheters are fine. These may be used to cross the lesion initially by using very soft neurointerventional guide wires.
 - Any guide wire/catheter combination you feel comfortable with is best.
 - Use the one you think gives you the best "feel" and "control" to assure you are intraluminal without dissection.

Microcatheters

Manufacturer: Target/BSC	Renegade®
	Turbo Tracker®
	Excel®
Cordis/J&J	Rapid Transit®
	Prowler ® (plus or 14)

Guide wires

Manufacturer: Target/BSC	Transcend®
Cordis/J&J	Agility® (14)

□ Guiding catheters

6F is adequate for most coronary balloons and stents. May want to consider a larger catheter or a long (90 cm) introducer sheath if you expect a lot of pushing to get balloons/stents to lesion

Manufacturer: Cordis/J&J	Envoy® /Vista brite tip® Guide brite tip® sheath
Cook	Shuttle® sheath
Arrow	Super Arrow Flex® sheath

Arrow is flexible but quite large outer versus inner diameters

□ Interventional guide wires

All of the balloon systems are 0.014" compatible. Unless one is sure they are going to use a monorail system (RX, rapid exchange) and are sure they're not going to have any problems (and you'll never know that), the wire needs to be an exchange length. Due to the long guiding catheters/sheaths plus the long balloon/stent systems (135 cm), the wire needs to be 300 cm in length--typical coronary wire.

Regarding wire stiffness, one must determine where the wire tip will need to be and how much support is needed within the guiding catheter/sheath. If the wire is to go in the MCA/ACA/PCA, obviously the tip needs to be very soft, as does the distal portion of the wire body. If the tip is only going to the ICA itself, the tip can be a little stiffer.

Manufacturer: SciMed/BSC	Choice PT®
Guidant/ACS	Traverse®
	Balanced® Wires (BMW)
	Whisper® wire
Cordis/J&J	Wisdom® wires
	Stabilizer®

□ Balloons

Balloons are needed for pre-dilation and post dilation

May not need to do either but should be prepared for both

Balloons need to be soft, flexible and available in a number of lengths and sizes.

One also needs to consider the compliance of the balloons for difficult (high stenotic, calcified, etc.) lesions and for sizing.

Manufacturer: Guidant/ACS	Open Sail®/Cross Sail®/High Sail®
Scimed/BSC	Maverick® NC Ranger®
Cordis/J&J	Talon®/Gazelle® NC Rapture®

□ Stents

Stents, like the balloons need to be of very low profile and quite flexible. One may not know if one can get the stent in place until one tries! I have found it somewhat difficult to predict. As with peripheral angioplasty, there are two basic types of stents: balloon expandable and self-expanding, most coronary applications use the latter and there are many more of these available.

Balloon Expandable

Manufacturer: Medtronic/AVE	S7®/S660®
Cordis/J&J	Velocity®
Guidant/ACS	Multi-Link Penta®/Pixel®
BSC	Nir (NirRoyal) Elite®
Abbott Lab	BiodivYsio SV®

Self Expanding

Manufacturer: BSC	Magic Wallstent® Radius®
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The above are suggestions based on my opinions. The manufacturers/products are the ones I am used to and you may find ones that suit your needs better. In addition, the products are changing almost daily often with substantial improvements so try your best to keep abreast with what is the latest and greatest (and what is not).

BSC=Boston Scientific Corporation

ACS=Advanced Cardiovascular Systems, Inc.

J&J=Johnson and Johnson Co.

AVE=Arterial Vascular Engineering

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